



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

Explanation of Significant Difference (ESD # 1)
to
Record of Decision

**Hassayampa Landfill Superfund Site
Maricopa County, Arizona**

December 2009

I. Introduction

The Hassayampa Landfill Superfund Site ("Site") is located in Maricopa County, Arizona. The Site was listed on the National Priorities List ("NPL") on July 22, 1987. The United States Environmental Protection Agency, Region IX ("EPA") issued the Record of Decision ("ROD") on August 6, 1992. The soil vapor performance standards in the ROD were met in 1998 and the SVE system was turned off. In 2006, a study was undertaken to determine the cause of some unexpected migration of contaminants in the ground water. As part of this study, a new soil vapor extraction system was installed and operated at the site. On the basis of the study, EPA concluded that the soil vapor performance standards in the ROD were inadequate to protect ground water. EPA is the lead agency for the Site and the Arizona Department of Environmental Quality (ADEQ) is the support agency.

This Explanation of Significant Difference ("ESD") revises the soil vapor performance standards in the ROD and modifies the treatment technologies for soil vapor extraction selected by EPA in the remedial action. This ESD was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("CERCLA") section 117(c), as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA"), the National Oil and Hazardous Substances Contingency Plan ("NCP"), 40 CFR 300.435(c)(2)(i), and "A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents," July 1999. This ESD is based on information contained in the Administrative Record for the Site.

This ESD will become part of the Administrative Record File (40 CFR 300.825(a)(2)), and will be available for review from 8:00am to 5:00pm Monday through Friday, excluding holidays, at EPA Region IX Superfund Records Center, 95 Hawthorne St., San Francisco, CA. The Administrative Record File is also available for review at the Buckeye Library, 310 North Sixth Street, Buckeye, AZ (623-386-2778) from 9:00am to 7:00pm Monday through Friday. Selected Hassayampa Landfill documents are available to review at the ADEQ Records Center, 1110 West Washington Street, Phoenix, Arizona (602-771-4380) from 8:30 am to 4:30 pm Monday through Friday.

II Summary of Site History, Contamination Problems, and Selected Remedy

The Hassayampa Landfill Superfund site is geographically situated approximately forty miles west of Phoenix and approximately three miles north of Arlington, in Maricopa County, Arizona. The Hassayampa Landfill is a portion of a seventy-seven acre property owned by Maricopa County, in which forty-seven acres were used for disposal of municipal and domestic solid waste, including a ten-acre former Hazardous Waste Disposal Area located in the northeast section of the landfill. For purposes of the ROD and this ESD, the "site" shall be defined as the 10-acre area of the 47-acre municipal landfill where hazardous wastes are known to have been disposed, as well as any areas where site-related contaminants have come to be located. The landfill lies within the drainage area of the ephemeral Hassayampa River, which is located 3/4 mile east of the landfill, but outside of the 100-year floodplain. Several water-bearing geologic units have been identified beneath the site with a general groundwater flow of south-southwest.

There were no residents living in the immediate vicinity of the site when it was listed but there has been an increase of residential developments near the site in recent years. Wells within three miles of the site provide drinking water to approximately 350 people and irrigation for 2,800 acres of farmland. The nearest downgradient residential well is about 1,000 yards south of the hazardous waste area.

Maricopa County began operating Hassayampa as a municipal landfill beginning in 1961. During an eighteen month period from April 20, 1979 to October 28, 1980, hazardous wastes were disposed in unlined pits in a 10 acre area in the northeast section of the landfill. This disposal occurred under a manifest program operated by the Arizona Department of Health Services (ADHS) in response to an "extreme emergency" that resulted from an ADHS ban on the disposal of industrial waste at City of Phoenix landfills. When landfills along the Salt River were closed to industrial waste disposal due to flooding, industrial waste was transported and disposed of at the Hassayampa Landfill site. ADHS used a manifest system to screen and track industrial waste deliveries to the landfill during this period. Under this program, a wide range of hazardous wastes were approved by ADHS for disposal at the Hassayampa Landfill, including up to 3.28 million gallons of liquid wastes and 4,150 tons of solid wastes. Manifests were used to document the volume and type of wastes and the names of the generators and transporters. The landfill pits were subsequently covered with native soil and restored to grade at the end of the eighteen month period. Disposal to the municipal landfill ceased in June, 1997.

A ROD for the Hassayampa Superfund site was signed on August 6, 1992 and detailed EPA's selected cleanup remedy. The selected remedy for the contaminated groundwater at the site set forth by the ROD included: pumping the groundwater; treating the contaminated water using an air stripping system; reinjecting the treated water back into the groundwater in the vicinity of the site; and performing continued groundwater monitoring to measure the ongoing effectiveness of the remedy. EPA selected the federal and state MCLs as cleanup standards for the groundwater. MCLs indicate the maximum level of a contaminant EPA considers safe in drinking water. For those contaminants for which MCLs had not been established, proposed MCLs or Health Based Guidance Levels (HBGLs) identified by the Arizona Department of Environmental Quality were selected as groundwater cleanup levels. HBGLs were developed by the ADHS and represent

human ingestion levels in water which are unlikely to result in adverse health effects during long-term exposure.

The ROD also required the removal and treatment of contaminated vapor present in the soil through the use of Soil Vapor Extraction (SVE) vents, and a treatment system that was determined during the remedial design. The soil vapor cleanup standards were to be established by the EPA through site-specific analytical modeling to be protective of groundwater quality. Finally, the ROD called for a protective cover (landfill cap) meeting federal requirements to be placed over the entire ten acre hazardous waste portion of the landfill. The cap system was chosen to reduce infiltration of rainwater, thereby limiting continued movement of soil contaminants to groundwater and also improving the efficiency of the soil vapor extraction system. The selected remedy also included the use of deed and access restrictions to control future use of the property. The cap and deed and access restrictions were also chosen to prevent people from coming into contact with contaminated soil at the site.

Following issuance of the ROD, EPA commenced negotiations with over 89 potentially responsible parties ("PRPs") toward a proposed settlement agreement, called a Consent Decree, under which the PRPs would implement the remedy selected in the ROD. Following the Consent Decree, the Hassayampa Steering Committee PRPs have undertaken the majority of the work at Hassayampa. A soil cap was constructed in 1994 to prevent erosion and infiltration of contaminants into the groundwater. A pump and treat groundwater remediation system was completed and has been in operation since March 1994. To date, this system has pumped and cleaned over 25 million gallons of contaminated groundwater.

A soil vapor extraction system was constructed and began operation in 1996 and operated intermittently until September 1998. During this period of time, it is estimated that the soil vapor extraction system treated (using thermal oxidation methods) approximately 3,700 pounds of VOCs. Site-specific modeling was performed on the site and it was determined that the soil vapor performance standards were being met in accordance to the requirements of the ROD.

After termination of the SVE system in September, 1998, monitoring data indicated upward trends in the size and concentration of the vadose zone vapor plume. In addition, there was an unexpected upgradient migration of contaminants in groundwater. In March 2006, a new SVE system was installed at the site removing soil vapors from above and below the basalt layer at the site, which continues to operate to this date.

III Description of the Significant Difference and the Basis for that Difference

A. Revised Soil Vapor Performance Standards

The 1992 ROD requires that the soil vapor cleanup standards be protective of groundwater quality and established through site-specific analytical modeling. Due to the uncertainties of the site conceptual model for the Hassayampa Landfill Superfund site and the wide range of parameters that could affect the modeling, EPA now has determined that the soil vapor performance standards should be derived in a different manner. As opposed to modeling that

relies upon estimating unknown parameters (e.g. thickness of basalt, lateral extent of migration of vapors) the new performance standards are based on calculations using State regulatory standards and Federal guidance for soil screening levels and converted to soil vapor levels at equilibrium. The ROD also specifies that either a vapor phase carbon adsorption unit or a catalytic oxidation system will be used for the soil vapor extraction system. Due to recent developments in technology and economic factors, this ESD allows for use of a third type of soil vapor extraction system technology that is more environmentally protective.

The regulatory standards that were mainly utilized were the Arizona Minimum Groundwater Protection Levels (GPLs) for organic contaminants from the ADEQ document "A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality" [ADEQ, 1996]. However, because Arizona Minimum GPLs are not published for every VOC analyte targeted for soil vapor performance goal development, soil vapor performance goals were calculated for remaining compounds in accordance with the methods described by the soil screening guidance tool developed by USEPA in 1996. This guidance provides a methodology to calculate site-specific Soil Screening Levels (SSLs) [EPA, 1996]. The specific calculations used to derive the new soil vapor performance standards are listed in Appendix I and the revised soil vapor standards for each analyte are listed in Appendix II.

B. New Soil Vapor Treatment Technology

The current 1992 ROD states that soil vapor extraction will use either vapor phase carbon adsorption or a catalytic oxidation system. As part of a 2006 investigation of the unusual migration of contaminants at the site, additional ground water and soil vapor monitoring wells were installed above and below the basalt layer. Results from these new monitoring wells included vapor concentrations beneath the basalt layer exceeded 900,000,000 ug/kg total VOCs. In response to these extremely high vapor concentrations, a new SVE system was installed rather than retrofitting the existing catalytic oxidation system. The new SVE treatment system changed the off-gas treatment to a cryogenic proprietary technology. The cryogenic SVE system is a compression / condensation technology that consists of three steps: an extraction / pressurization step, a condensation step, and a polishing step.

Following extraction of the soil vapor by the blower, the extracted vapors are pressurized to 10 atm (the extraction / pressurization step). The vapor stream then is cooled to -40 degrees Fahrenheit. At this combination of high pressure and low temperature, the majority of VOCs change phase from vapor to the liquid phase (the condensation step). The vapor stream is then polished using a regenerative adsorber and two 400-lb vapor-phase granular-activated carbon (VGAC) vessels (the polishing step) prior to discharge to the atmosphere.

The cryogenic soil vapor compressor/condensation unit produces two primary recovered liquid streams: an aqueous-based condensate (condensate) and an organic-based solvent waste liquid (solvent waste). The solvent waste is stored in a 2,400-gallon pressure vessel and the condensate is stored in two polyethylene tanks (one 1,500 gallon and one 500 gallon) located on the

containment pad. Both the solvent waste and condensate are shipped in the same event using a double hull tanker to an EPA approved disposal site. The granular activated carbon contained in the two 400-lb polishing carbon vessels is periodically removed and replaced.

At some point in the future when extracted VOC vapor concentrations are further reduced, it will become cost effective to change the off-gas treatment technology from the cryogenic system to vapor-phase carbon. The cryogenic system is most effective when it is used to treat high concentrations of VOCs while vapor-phase carbon is more practical at relatively lower concentrations of VOCs. The use of vapor phase carbon off-gas treatment technology is identified in the ROD for the Site, so this future change in treatment technology for the vapor will not require further changes to the remedy.

IV Support Agency Comments

This ESD only revises the soil vapor performance standards in the Record of Decision (ROD) and modifies the treatment technologies for soil vapor extraction selected by EPA in the remedial action. As specified in the ROD, soil vapor cleanup standards would be determined later through site-specific analytical modeling. The soil vapor cleanup standards will be levels that are protective of groundwater quality, meaning that the migration of contaminants from the vadose zone to groundwater will not result in groundwater contamination that exceeds the groundwater cleanup standards. The soil vapor performance standards shall insure that the remedy continues to provide adequate protection of human health and the environment.

Upon meeting the specified soil vapor performance standards, the soil vapor extraction system may be shut down. If however, any groundwater contaminant concentrations increase and exceeds groundwater cleanup standards, the soil vapor extraction system shall return to operating status. The soil vapor extraction system will be operated as per the Soil Vapor Performance Standards Verification Plan.

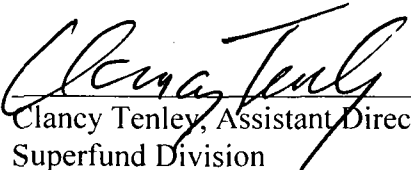
The support agency, ADEQ, participated in, and has been adequately informed during the development of this ESD #1. ADEQ supports its conclusions.

V Affirmation of the Statutory Determinations

Considering the changes that have been made to the selected remedy, EPA believes that the revised remedy remains protective of human health and the environment, and is cost effective. The revised remedy complies with federal and state requirements identified in the ROD as applicable, relevant and appropriate requirements ("ARARs") and satisfies section 121 of CERCLA.

VI Public Participation Compliance

The public participation requirements set out in the NCP, 40 CFR 300.435(c)(2)(I) will be met by publication of notice in the Arizona Republic that the ESD has been signed and that the contents of the Administrative Record File are available. Such notice will include a brief description of the ESD.


Clancy Tenley, Assistant Director
Superfund Division
U.S. EPA, Region IX

12.23.09
Date

APPENDIX I: REVISED SOIL VAPOR PERFORMANCE STANDARDS

Volatile Organic Compound	Arizona GPLs ¹ (mg/kg)	Site Specific SSLs ² (mg/kg)	Vapor Equivalent Soil Vapor Performance Standards ³ (µg/L)
Acetone	-	76.260	1.04E+03
Benzene	0.71	-	8.07E+02
2-Butanone	-	19.159	3.64E+02
Chlorobenzene	-	33.010	1.43E+04
Dichlorofluoromethane	-	2682.030	2.15E+07
1,2-Dichloroethane	0.21	-	6.13E+01
1,1-Dichloroethene	0.81	-	2.85E+03
1,2-Dichloroethene (cis)	4.9	-	4.81E+03
1,2-Dichloroethene (trans)	8.4	-	1.52E+04
1,2-Dichloropropane	0.28	-	1.87E+02
Methylene Chloride	-	0.645	4.21E+02
Tetrachloroethene	1.3	-	2.74E+03
Toluene	400	-	3.31E+05
1,1,1-Trichloroethane	1.0	-	2.30E+03
Trichloroethene	0.61	-	7.80E+02
Trichlorofluoromethane	-	1318.402	7.80E+06
Trichlorotrifluoroethane	-	541710.152	3.86E+09
Vinyl Chloride	-	0.492	2.08E+03
Xylene (total)	2200	-	1.14E+06

Notes:

(1) Arizona Department of Environmental Quality (ADEQ), 1996. A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality. September 1996

(2) United States Environmental Protection Agency (USEPA), 1996. Soil Screening Guidance: User's Guide Second Edition. July 1996.

(3) Calculated from soil concentrations

$$C_v = \frac{C_s \cdot P_b}{K_{oc} f_{oc} P_b / H_c + \theta_w / H_c + (\theta_T - \theta_w)}$$

APPENDIX II: TECHNICAL APPROACH FOR DEVELOPMENT OF REVISED SOIL VAPOR PERFORMANCE STANDARDS

1.1 General

Prior to the construction and operation of the original SVE system, soil vapor performance standards were developed for the Site in 1994 using computer modeling. Following shutdown of the original SVE system in accordance with the aforementioned 1994 soil vapor performance standards, VOC concentrations exhibited increasing trends in soil vapor and in several Unit A groundwater monitoring wells, including upgradient well MW-11UA. Further investigation performed in 2006 supported an updated Site Conceptual Model (SCM) that identified dissolution of VOCs from soil vapor into groundwater as a significant migration pathway to Unit A groundwater. Considering the updated SCM and the above noted trends, it can be concluded that the 1994 soil vapor performance standards require updating.

1.2 Technical Approach

Site-specific groundwater performance standards have been established for the Site. The standards are a combination of Federal or State Maximum Contamination Levels (MCLs) and Health Based Guidance Levels (HBGLs) identified by ADEQ or the Arizona Department of Health Services (ADHS). This section describes the development of soil vapor performance standards for each VOC that has a groundwater performance standard; this approach is based on the premise that the ultimate remedial objective the SVE remedy component is to protect groundwater quality.

The updated 2009 soil vapor performance standards for these VOCs were developed using a combination of the following:

- Regulatory standards; and
- Agency guidance that provides a process for calculating concentrations of specific analytes that may be left in soil that would not result in an exceedance of a target or specified groundwater concentration. For the application detailed in this document, the target groundwater concentrations are the site-specific groundwater performance standards (Table 3-1).

When available, the regulatory standards that were utilized were the Arizona Minimum Groundwater Protection Levels (GPLs) for organic contaminants from the ADEQ document "A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality". However, because Arizona Minimum GPLs are not published for every VOC analyte targeted for soil vapor performance goal development, soil vapor performance standards were calculated for remaining compounds in accordance with the methods described by the soil screening guidance tool developed by USEPA in 1996. This guidance provides a methodology to calculate site-specific Soil Screening Levels (SSLs).

It should be noted that both the Arizona GPLs and the USEPA methods used to develop site-specific SSLs yield allowable total soil concentrations. Additional calculations were performed to convert the soil concentrations to soil vapor concentrations at equilibrium conditions, which are then presented as the updated 2009 soil vapor performance standards for the Site.

The updated soil vapor performance standards will be used to guide operation of the SVE system and provide a set of criteria from which to evaluate when shutdown of the system is appropriate. Details regarding the development of the soil vapor performance standards using the Arizona Minimum GPLs and USEPA SSL methodology are provided in the following sections.

1.3 Arizona Groundwater Protection Levels

Where available, Minimum GPLs were used to derive soil vapor performance standards for targeted VOC analytes. Minimum GPLs were obtained from the ADEQ document "A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality." In September 1994, the ADEQ's Cleanup Standards Task Force developed a contaminant fate-and-transport model to calculate potential impacts on groundwater quality due to residual soil contamination. Based on this model, Minimum GPLs for organic contaminants were developed using federal maximum contaminant levels (MCLs) as a groundwater threshold.

Minimum GPLs were developed as conservative levels for groundwater protection. Minimum GPLs represent soil concentrations protective of groundwater quality in a "worst-case" situation, where the entire soil profile is contaminated from surface to just above the groundwater surface. The input model parameters used to develop the Minimum GPLs provide for very conservative protection levels. "If a pre-determined or site-specific soil cleanup standard is not protective of groundwater quality, a Minimum GPL can be used to ensure groundwater protection."

If an Arizona Minimum GPL was not published for VOC analytes targeted for soil vapor performance goal development, a value was calculated using the USEPA Soil Screening Guidance tool.

1.4 USEPA Soil Screening Levels

In July 1996, the USEPA developed the "Soil Screening Guidance: User's Guide" to help standardize the evaluation and cleanup of contaminated soils at sites and provide a methodology to calculate site-specific SSLs. The guidance provides a step-by-step methodology to calculate site-specific SSLs from specified groundwater performance standards using a series of equations described in this section.

The methodology for developing SSLs for the migration to groundwater pathway is based on rather conservative, simplified assumptions about the release and transport of contaminants in the subsurface. The soil screening guidance tool uses a simple linear equilibrium soil/water partition equation that relates concentrations of adsorbed soil contaminants to soil leachate concentrations in the zone of contamination. It also uses a water balance equation to calculate a Dilution Attenuation Factor (DAF) to account for reduction of soil leachate concentrations due to localized mixing in an aquifer. An estimated mixing zone depth (d) of 1.62 meters (Equation 1) is used along with other site-specific variables to calculate the DAF value (Equation 2) from the mixing zone equation. The mixing zone equation, derived from a water-balance relationship, was used to calculate a site-specific DAF of 938 using site-specific aquifer and soil data.

The soil/water partition equation calculates SSLs corresponding to a target soil leachate contaminant concentration, C_w . In this document, C_w values are the site-specific groundwater performance standards for each VOC analyte multiplied by the DAF (Equation 3).

Table 3-2 lists the VOC analytes and the calculated SSLs in units of total soil concentration. The step-by-step methodology used to calculate the SSL for an example VOC (Acetone) is shown below.

Calculating Mixing Zone Depth (d)

$$d := \left(0.0112 L_a^2 \right)^{1/5} + d_a \left(1 - e^{-\frac{L_a \cdot I}{K \cdot d_a}} \right) \quad (1)$$

where L_a = Source Length Parallel to Groundwater Flow = 15.24 m

d_a = Aquifer Thickness = 10.7 m

I = Infiltration Rate = $0.0018 \cdot P^2$ (where $P = 0.217$ m/yr) = 8.5×10^{-5} m/yr

K = Aquifer Hydraulic Conductivity = 238.3 m/yr

$$i = \text{Hydraulic Gradient} = 3.15 \times 10^{-3} \text{ m/m}$$

From Equation 1,

$$d = \left[\frac{0.0112(15.24 \text{ m})^2}{5} + (10.7 \text{ m}) \right] \cdot \frac{1}{1 - e^{-\left(\frac{(-15.24 \text{ m}) \cdot 0.018 \left(\frac{2172 \text{ m}}{\text{yr}} \right)^2}{\left(\frac{238.3 \text{ m}}{\text{yr}} \right) \left(\frac{3.15 \times 10^{-3} \text{ m}}{\text{m}} \right) \cdot (10.7 \text{ m})} \right)}}$$

$$d = 1.62 \text{ m}$$

Calculating Site-Specific Dilution Attenuation Factor (DAF)

$$\text{DAF} = 1 + \frac{K \cdot i \cdot d}{i \cdot L_a} \quad (2)$$

From Equation 2,

$$\text{DAF} = 1 + \frac{\left(\frac{238.3 \text{ m}}{\text{yr}} \right) \left(\frac{3.15 \times 10^{-3} \text{ m}}{\text{yr}} \right) \cdot (1.62 \text{ m})}{\left(\frac{8.5 \times 10^{-5}}{\text{yr}} \right) \cdot (15.24 \text{ m})}$$

$$\text{DAF} = 938$$

Calculating Target Soil Leachate Contaminant Concentration for Acetone (C_w)

$$C_w = \text{Acetone Site Specific Groundwater Performance Standard} \times \text{DAF} \quad (3)$$

where Site Specific Groundwater Performance Standard for Acetone = 700 $\mu\text{g/L}$
DAF = 938 (from Equation 2)

From Equation 3,

$$C_w = \left(7 \frac{\text{mg}}{\text{L}} \right) \cdot 938$$

$$C_w = 657 \frac{\text{mg}}{\text{L}}$$

Calculating Soil Screening Level for Acetone (SSL)

$$\text{SSL} = C_w \left[K_{oc} \cdot f_{oc} + \frac{(\theta_w + \theta_a \cdot H)}{\rho_b} \right]$$

(4)

where K_{oc} = Organic Carbon Partition Coefficient = .575 L/kg

f_{oc} = Fraction Organic Carbon in Soil = 0.001 (unitless)

θ_w = Volumetric Water Content = 0.15 (unitless)

θ_a = Air-Filled Soil Porosity = 0.15 (unitless)

H_c = Henry's Law Constant = .00159 (unitless)

ρ_b = Dry Soil Bulk Density = 1.3 kg/L

From Equation 4,

$$SSL = \left(657 \frac{\text{mg}}{\text{L}} \right) \left[\left(166 \frac{\text{L}}{\text{kg}} \right) (.001) + \frac{(.15) + (.15)(.442)}{\left(1.3 \frac{\text{kg}}{\text{L}} \right)} \right]$$

$$SSL = 76.3 \frac{\text{mg}}{\text{kg}}$$

1.5 Updated Soil Vapor Performance Standards

To derive the updated soil vapor performance standards, the soil concentrations developed using Minimum GPLs and SSLs were expressed as equivalent soil vapor concentrations at equilibrium. The use of soil vapor performance standards is preferred over soil-based values given the extensive existing soil vapor monitoring network installed in the coarse-grained, fine-grained, and sub-basalt vadose zones of the Site. Additionally, soil vapor data can be collected on a frequent basis and with greater ease than soil data, especially given the presence of the geomembrane liner over a majority of the Site.

The soil concentrations derived from the Minimum GPLs and calculated SSLs were converted to equilibrium vapor concentrations using Equation 5. The methodology used to calculate the equilibrium vapor concentration for acetone from the site-specific SSL (calculated from Equation 4) is shown below.

Calculating Soil Vapor Equivalent for Acetone (C_v)

$$C_v = \frac{C_{ss} \rho_b}{\frac{K_{oc} f_{oc} \rho_b}{H_c} + \frac{\theta_w}{H_c} + (\theta_T - \theta_w)} \quad (5)$$

where C_s = Soil Concentration (Acetone SSL) = 76.3 mg/kg or 7.63×10^4 ug/kg

θ_T = Total Porosity = 0.3 (unitless)

From Equation 5,

$$C_v = \frac{\left(7.63 \cdot 10^4 \frac{\mu\text{g}}{\text{kg}}\right) \left(1.3 \frac{\text{kg}}{\text{L}}\right)}{\left(575 \frac{\text{L}}{\text{kg}}\right) \cdot (.001) \cdot \left(1.3 \frac{\text{kg}}{\text{L}}\right)} + [(0.3) - (.15)]$$

$$C_v = 1040 \frac{\mu\text{g}}{\text{L}}$$

The resulting soil vapor concentrations, which constitute the updated soil vapor performance standards, are summarized on Appendix 1.